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The bladder of willful infrequent voiders: Underactive or underutilized?

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Abstract *Objective:* We previously described a lower urinary tract (LUT) condition (detrusor underutilization disorder, DUD) characterized by chronic or episodic willful deferment of voiding resulting in an expanded capacity in patients with LUT symptoms. We now further characterize these DUD patients.
Materials and methods: We reviewed our database identifying neurologically/anatomically normal children diagnosed with DUD. Bladder capacity had to be at least >125% EBC for age to be included. LUTS, diaries and uroflow/EMG findings were analyzed.
Results: Fifty-five children (mean age 10.5 years, range 3.7—20.2; 34F, 19M) with LUTS were diagnosed with DUD. The most common reasons for presentation included incontinence (43.6%), history of urinary tract infection (UTI) (49.1%), and urgency (30.9%). Mean percent estimated bladder capacity for age was 1.67 and following treatment mean %EBC decreased to 1.10.
Conclusions: DUD patients typically present with infrequent voiding, incontinence, urgency, and UTIs. They have less bowel dysfunction and frequency, and larger bladder capacities than typically found in children with overactive bladder and dysfunctional voiding. Although the symptoms associated with DUD overlap in part with those considered by the International Children's Continence Society to be typical for "underactive bladder" and "voiding postponement", DUD, we feel, is a stand-alone diagnosis.

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Introduction

Detrusor underutilization disorder (DUD) is an acronym for a urodynamically defined lower urinary tract (LUT) condition, previously described by us, in which the hallmark feature is chronic or episodic, willful deferment of voiding [1—4]. Patients are typically described as either having large voiding volumes (two to three times a day), or periodically deferring voiding for extended periods of time, often 8—10 h, particularly when away from home [1]. This underutilization of the bladder results in an expanded bladder capacity (>125% expected bladder capacity, EBC) and can lead to infections from prolonged periods of stasis. Additionally, patients may also experience urgency with or without incontinence provoked by bladder over-distension and sometimes associated with observed holding maneuvers to prevent leakage or delay voiding. Voiding in these patients is otherwise normal, and diagnostic uroflow/electromyography (EMG) demonstrates a quiet pelvic floor during voiding, a flow pattern that is typically normal and a post void residual (PVR) that rarely exceeds 10% of voided volume [3,4]. DUD is not a rare condition and can be diagnosed in approximately 5—9% of anatomically and neurologically normal children with LUT dysfunction who undergo evaluation with uroflow/EMG or urodynamic studies (UDS) [1,3]. Although the condition of DUD overlaps in symptomatology with the International Children's Continence Society's (ICCS) "daytime conditions" of voiding postponement and underactive bladder, it is at the same time distinctly different from both conditions. This condition we call DUD, although presently not addressed by ICCS terminology, we certainly believe that anyone involved in the evaluation of children with LUT dysfunction has encountered it and strongly feel that it should be designated as a condition unto itself.

The objective of this study is to further clarify the diagnosis of DUD through the characterization of patients based on their presenting LUT symptoms, uroflow/EMG parameters, and, when obtained, UDS findings as well. In addition, we wanted to describe how DUD differs from presently defined ICCS "daytime conditions".

Materials and methods

We retrospectively reviewed our IRB-approved pediatric urology database to identify neurologically and anatomically normal children presenting with LUT symptomatology and diagnosed with DUD on uroflow/EMG testing. All patients underwent an extensive history, physical examination, urinalysis and uroflow/EMG testing. A LUTS and bowel habit questionnaire was obtained, as well as a standard voiding diary. If indicated, patients underwent a formal UDS in accordance with the International Continence Society (ICS) recommendations [5,6].

Bowel dysfunction was divided into constipation alone, encopresis alone, or constipation and encopresis together. Only patients with active bowel dysfunction at time of initial evaluation or patients being managed on active bowel therapy/program were reported as having bowel dysfunction. The diagnosis of bowel dysfunction was based on a combination of elimination diary, patient/parent reporting, physical examination, Bristol stool grade, Rome III criteria, and corn transit time in some children [7,8]. In addition, the presence of rectal dilation on pelvic ultrasound was looked for in all patients at the time of their uroflow/EMG studies, although dilation of the rectum in and of itself without supportive history and/or symptoms, was not enough to make the diagnosis of constipation. Abdominal plain radiography was rarely used and only in questionable cases when constipation was suspected but not fully supported by history and physical exam and/or further delineation of stool burden was desired [9,10].

Uroflow/EMG and urodynamic studies were performed with either a Mediwatch/Medtronic Duet system or Laborie Aquarius TT system. These units have EMG modules with high sampling rates and broad sensitivity yielding high-quality graphic images recorded as raw EMG, and EMG patches were placed at the 3 and 9 o'clock positions at the margin of the external anal sphincter. Each unit also has a high quality audio monitor for the differentiation between true motor unit recruitment activity and electrical artifact. All tests were performed when the patient expressed a sense of fullness or the sensation at which they would normally void. Real time abdominal ultrasound was performed prior to each uroflow/EMG and immediately (<60 s) after voiding to measure PVR as accurately as possible. Lower ureteral dilatation, bladder wall changes, and rectal dilation by a large stool mass were also specifically assessed. Voided volume, PVR, Qmax, Qave, and the presence or absence of EMG activity during the voiding phase were analyzed, as well as the EMG lag time, which is defined as the time between the onset of pelvic floor relaxation with permission to void and the start of urine flow. Capacity was reported as %EBC = (voided volume + PVR)/EBC, and only patients with an initial bladder capacity ≥1.25 times their EBC were included. EBC was based on the Koff formula of (age + 2 in years) × 30 [11]. An interpretation of each uroflow pattern as seen on uroflow/EMG was made on the basis of current ICCS guidelines. An interrupted/fractionated pattern was characterized by multiple discrete peaks in urine flow separated by segments with zero flow (also referred to as intermittent by the ICS), while a staccato pattern was characterized by multiple peaks and troughs where the magnitude of the fluctuations is larger than the square root of the maximum uroflow rate [5,6].

The majority of patients underwent two uroflow/EMG assessments and findings were compared with voiding diary data and reported history for goodness of fit. No patient was on anticholinergic therapy at the time of their evaluation. All studies were initially performed and interpreted by one of three physician extenders, and all studies subsequently went to one physician (KIG) for final review. All patients were treated with standard urotherapy as defined by the ICCS with the primary emphasis on timed voiding and the management of bowel dysfunction if present.

Results

Fifty-five patients (37 female, 18 male) with a mean age of 11 years (range 4—20) were diagnosed with DUD based on clinical history, physical examination, voiding diary findings, and uroflow/EMG study results. LUT symptoms at diagnosis are shown in Table 1. UTIs, both febrile and afebrile, were the major reasons for referral in this cohort of patients.